

Energy Efficiency

reducing America's utility bills



Reducing energy costs and improving energy storage are two ways BES research is helping meet the Nation's goals for increased conservation and more effective energy use. From rechargeable microbatteries to energy-efficient refrigeration, the energy technologies developed and transferred to industry by BES are aimed at meeting the public's demand for dependable, low-cost energy.

Many utility companies have sought the expertise of researchers to improve the efficiency and performance of their operations. One BES-industry project that investigated energy losses from transformers found a way to reduce those energy losses by a factor of 10. This one discovery could significantly reduce the estimated \$1 billion lost each year as a result of energy inefficiencies in transformer materials.

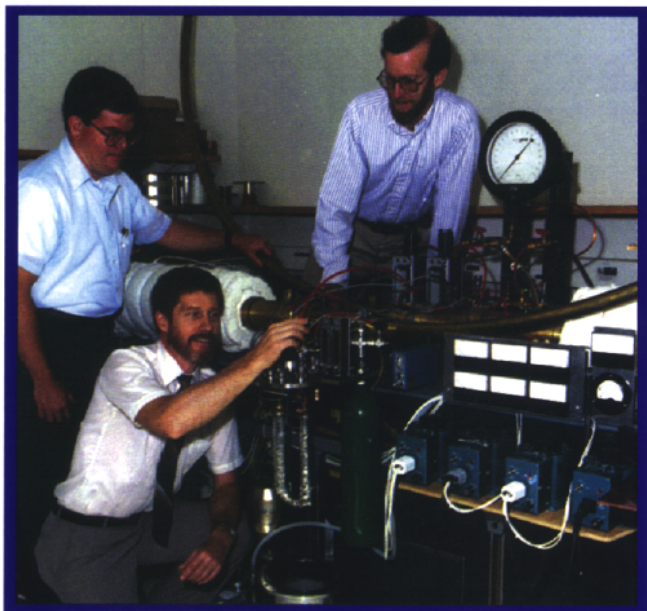
BES researchers are also working with industry to develop environmentally safe industrial burners that

Tests and evaluations by AlliedSignal and Ames Laboratory have shown that making improvements in the processing of the core magnets used in transformers reduces energy losses by up to a factor of 10. Their research suggests that postprocessing improvements, such as surface annealing and laser scribing, could enhance the magnetic properties of the transformer materials, significantly reducing the estimated \$1 billion lost each year as a result of inefficiency in these materials.

can maintain flame stability, yet emit low levels of nitrogen oxides (precursors to acid rain and contributors to the formation of smog). The results have been used in the design of a burner for metals processing that reduces typical nitrogen oxides emissions by over 90 percent.

New designs and enhanced performance may one day soon make nuclear power a more attractive energy option. Current research is looking to design longer lasting materials that can better withstand the neutron environment of a nuclear reactor. Researchers are also working on perfecting a technique that detects stress-corrosion cracks in the early stages by "listening" for the sounds that the cracks make as they grow. These efforts, in turn, will help reduce component failure in materials used in electric power generation.

Ultralow-temperature thermoacoustic refrigeration devices have been developed as a result of BES research in thermodynamics and acoustics. These new refrigerators, which cool without moving parts, are more reliable, longer lasting, and environmentally safer (no chlorofluorocarbons) than conventional refrigerators.

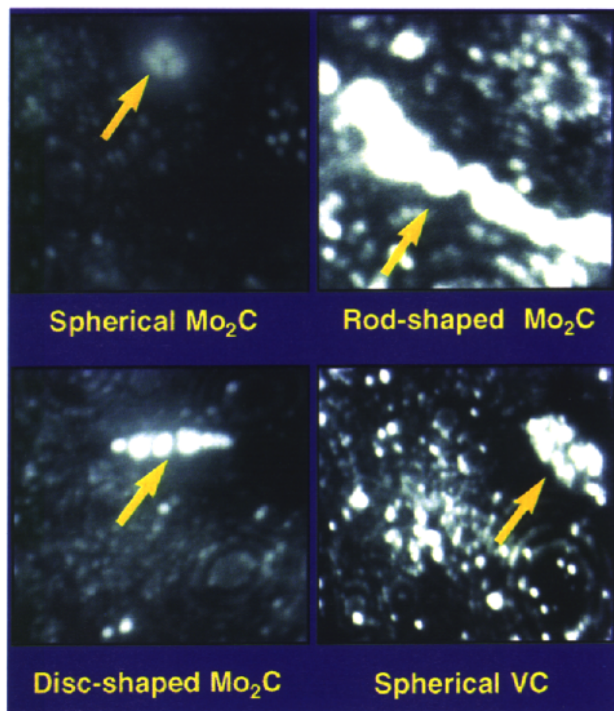
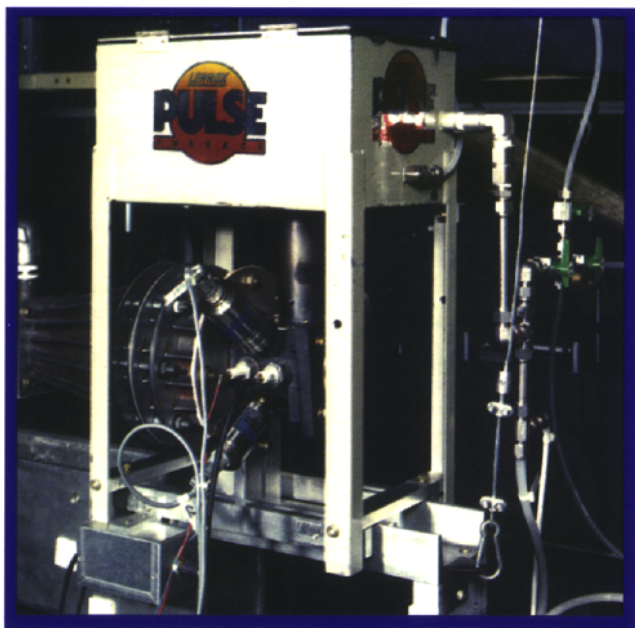


Thermoacoustic Power

(left) Research in thermodynamics and acoustics at Los Alamos National Laboratory has led the way for several companies, including Cryenco and Ford Motor Company, to develop power and refrigeration systems that are simpler and longer lasting than conventional units. Researchers dubbed the first cryogenic thermoacoustic device, developed by Los Alamos in collaboration with the National Institute of Standards and Technology, a "Coolahoop" because the brass portion of the acoustic resonator that extends upward resembles a "hula-hoop."

Pulse Combustion

(below) Experiments at Sandia National Laboratories' Combustion Research Facility help companies such as Lennox Industries improve and expand their product lines. Recent work has demonstrated that pulse combustors such as the one shown here can achieve ultralow emission levels without postcombustion cleanup technologies.



Visualizing Defects

(above) Several companies have drawn on the expertise of Pacific Northwest National Laboratory and Oak Ridge National Laboratory to study microstructural changes in materials used in nuclear power systems. Currently, collaborative projects are under way with Westinghouse Bettis Laboratories and the Electric Power Research Institute. These efforts use microscopy techniques to investigate defects caused by exposure to radiation of materials used in the pressure vessel and structure of reactors.